DEVELOPMENT OF COMMERCIAL FLOOD DEPTH-DAMAGE CURVE FOR KUANTAN, PAHANG

SHAFIEQ AIMAN BIN SHAMSUDDIN

B. ENG (HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

_____

(Student's Signature)

Full Name : SHAFIEQ AIMAN BIN SHAMSUDDIN

ID Number : AA15076

Date : 25 May 2019

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SHAFIEQ AIMAN BIN SHAMSUDDIN

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ABSTRAK

Banjir mendatangkan konsekuensi yang buruk kepada komuniti dan individu. Seperti yang sedia maklum, kesan langsung banjir termasuk kehilangan nyawa, kerosakan harta benda, kemusnahan tanaman, kehilangan ternakan, dan kemerosotan kesihatan akibat penyakit air. Impak banjir biasanya dinilai melalui penilaian kerentanan akibat banjir. Walaubagaimanapun, di Malaysia kajian kerentanan akibat banjir adalah terhad terutama dari aspek anggaran kerosakan banjir. Oleh itu, tujuan utama kajian ini adalah untuk menganggar kerosakan banjir yang dialami pada tahun 2013 di Kuantan. Tinjauan temubual telah dijalankan untuk mengumpul maklumat kerosakan. Analisis regresi telah dijalankan bagi mengenalpasti faktor-faktor yang mempengaruhi tahap kerosakan dan satu lengkung kedalaman-kerosakan banjir telah dihasilkan bagi menggambarkan hubungan di antara tahap kerosakan (dalam peratusan) melawan tinggi air banjir. Peratusan kerosakan dikira dengan membahagikan kerosakan sebenar dengan anggaran kerosakan. Keputusan menunjukkan kerosakan isi premis adalah lebih tinggi berbanding kerosakan struktur. Purata kerosakan isi premis bagi premis dua tingkat ialah RM42,971 berbanding RM5,609 kerosakan struktur. Manakala kerosakan premis satu tingkat adalah lebih rendah iaitu RM23,103 (isi premis) dan RM4,161 (struktur). Berdasarkan jenis perniagaan, kerosakan isi premis bagi perniagaan barangan dan servis adalah lebih tinggi (RM35,974) berbanding perniagaan makanan dan minuman (RM11,813). Kerosakan struktur bagi kedua-dua kategori perniagaan adalah lebih rendah iaitu masing-masing adalah RM5,063 dan RM5,609. Dari analisis regresi didapati pendapatan perniagaan dan jenis perniagaan mempengaruhi kadar kerosakan isi premis, manakala kerosakan struktur hanya dipengauhi oleh aras premis. R^2 yang diperolehi bagi lengkung kerosakan-kedalaman banjir yang dihasilkan adalah baik iaitu 0.91 dan 0.86 masing-masing bagi kerosakan isi premis dan kerosakan struktur dan boleh digunakan untuk kajian penilaian risiko banjir di kawasan kajian pada masa depan.

ABSTRACT

Floods caused great consequences to communities and individuals. As most people are well aware, the immediate impacts of flooding include loss of life, damage to property, destruction of crops, loss of livestock, and deterioration of health conditions owing to waterborne diseases. The consequences of flooding are normally assessed by flood vulnerability assessment. However, in Malaysia, the studies on flood vulnerability are limited especially on flood damage. Therefore, the main purpose of this study is to assess flood damage during the 2013 Kuantan flood. Interview survey was conducted to collect the damage information. The regression analysis was performed to determine the factors that effects the level of flood damage and a depth-damage curve was developed to show the relationship between the damage in percentage and flood depth. The percentage of damage was obtained by dividing the actual damage with estimated damage. The result shows that content damage is higher than structural damage. The average content damage for two level premises is RM42,971, compared to RM5,609 for structural damage. While content damage for single level premises is lower which is RM23,103 (content) and RM4,161 (structural). According to the type of business, good & services content damage is higher (RM35,974) compared to food and beverages (RM11,813). The structural damage for both business category is lower which is RM5,063 and RM5,609 respectively. Regression analysis shows that business income and type of business are the variables that effects the level of content damage, while the structural damage was influenced only by the level of building. The R^2 for flood depth-damage curve is good enough which are 0.91 and 0.86 for content and structural damage respectively and can be used for future studies on flood risk assessment at the study area.

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LIST OF SYMBOLS

%	Percentage

LIST OF ABBREVIATIONS

TRMM	Tropical Rainfall Measuring Mission
JAXA	The Japan Aerospace Exploration Agency
RF	Random Forest
AHP	Analytic hierarchy process
SPA	Set pair analysis
FCE	Fuzzy comprehensive evaluation
RM	Ringgit Malaysia
PRB	Pahang River Basin
Sig.	Significant
KRB	Kuantan River Basin
IWUMD	Irrigation and Water Utilization Management Department

CHAPTER 1

INTRODUCTION

1.1 Introduction

Flooding is natural hazard that happen without exception. Natural hazards vary in magnitude and intensity in time and space (Tsakiris, 2014). Flood catastrophe widely gives huge impact towards life and property (Balica et al., 2013). The heavy rainfall, ice melting, high tide and blocked drain can cause the arise of water from river, lake and drainage systems (Fallis, 2013). There are few types of flood which are coastal flooding, river flooding, flash flood, groundwater flood and drainage and sewer flood (Dachalan, 2014).

The flood share common nature i.e. the potential to wreak havoc (Dachalan, 2014). This flood cause enormous economic damages and human suffering (A. K. Pistrika & Jonkman, 2010) and also leads to loss of life (Miller et al., 2015). However, according to Fallis (2013), flood gives few benefits towards agricultures and earth. Flood can nourish the soils where agriculture can take place and natural plants can growth (Fallis, 2013).

According to D/iya et al. (2014) there are two types of flood happen in Malaysia which are flash flood and monsoon flood. This types of flood distinguish by the time to recede to the normal level (D/iya et al., 2014). In Malaysia there are a few flood prone areas according to Dachalan (2014). East coast peninsular of Malaysia experienced the northeast monsoon that occurs between October and March (D/iya et al., 2014). According to Lang (2019), heavy rain lasting on the order of a few days are common during the northeast monsoon.

Many flood mitigation options have been adopted to mitigate the impact of flooding. Nowadays, the non-structural flood mitigation measures such as flood

modelling, flood warning system and flood risk assessment have been given more attention compared to structural works (Romali et al., 2018). In Malaysia, the risk of flooding is normally presented in term of its hazard e.g. flood inundation and flood extend map. The risk of flooding in terms of flood consequences is rarely assessed. Hence, the assessment of flood vulnerability is compelling to mitigate the impacts of flooding. The lack of study in vulnerability assessment gives minimum information about flood damage. In fact, flood damage estimation is the important element in the assessment of flood vulnerability.

1.2 Problem Statement

Kuantan River Basin (KRB) is one of the flood prone area in Pahang. Pahang was severely hit by the 2013 flood where almost 6000 household were affected (Star, 2013). According to Sean (2019) the worst hit district was Kuantan with 4,148 victims. Many flood hazard assessment works had been done at KRB, however, to date no flood vulnerability assessment is available.

Flood damage is essential in flood vulnerability assessment where it is needed in the development of flood risk mapping, risk analysis comparison and financial appraisals. However, conducting flood damage assessment in developing countries is challenging due to the limitation of data. The historical data is not available and collecting flood damage data is hard due to the lack of cooperation from respondent during the interview especially among commercial sector. It is difficult to meet personally with the owner of the building/shop as the shops are normally attended by the shop attendant but the information about the flood event was known by the business's owner.

As the assessment of flood damage within the commercial sector has not gained much attention so far, hence the main aim of this study is to assist in the commercial flood vulnerability assessment at Kuantan River Basin. The damage experienced by the commercial sector during the 2013 flood was assessed and the factors that effects the level of damages at the study area was identified. A commercial flood depth-damage curve was developed. The information of flood damages obtained in this study may be useful to assist engineer and local authorities in the further flood risk management works in minimizing the risk of damages caused by flood.

1.3 Objectives:

The objective of this study are:

1. To assess the commercial flood damages of 2013 Kuantan flood.
2. To study the relationship between flood damages and socio-economic/property characteristics of the study area.
3. To establish a commercial flood depth-damage curve for Kuantan.

1.4 Scope and limitation of study

The study was conducted in Kuantan, Pahang. Kuantan was being chosen as the study area due to its potential as the future hub of trade centres in Pahang. The commercial properties along the Kuantan's river was selected as the sampling area for interview survey during the data collection. The damage category assessed in this study is direct tangible damage, selected due to the limitation of damage data. This study focuses on the structural and content damage of properties, for commercial categories only.

1.5 Significance of study

The assessment of flood damages through interview survey is important in flood risk assessment to obtain the real picture of the damage that experienced by the commercial properties during the 2013 Kuantan flood. The identification of factors that influenced the level of flood damages is essential to study the effect of local condition of the study area to the flood damage. The flood depth-damage curve shows the relationship between the flood damage and the flood depth is needed in the modelling of flood damage.

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